A STUDY OF STATISTICAL DESIGN PUBLICATIONS FROM 1968 THROUGH 1971*

by

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Abstract

A summarization was made of the number of articles and the number of pages devoted to publication of papers on the statistical design and analysis of experiment designs, treatment designs, sample survey designs, sequential designs, and designs of model-building investigations. These articles were devoted mostly to the theoretical developments rather than to the use of a procedure in a specific investigation. Papers in 18 statistical journals for the four years 1968, 1969, 1970, and 1971 were included in the summarization. Six hundred fifty nine articles involving 7009 pages were published on statistical design and analysis during this four-year period.

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Some consideration has been given to founding an international journal devoted to the theory, application, and exposition of statistical design in surveys, experiments, model building, dynamic programming, systems analysis, and related areas. Reasons advanced for having a separate journal on statistical design and associated analyses were:

1. To focus attention on the broad and diverse aspects of statistical design which is one of the three major parts of the definition of statistics.
2. To bring together literature on statistical design which is presently scattered throughout scientific journals.
3. To relieve some of the pressure on journals such as the Journal of Combinatorial Theory.
4. To encourage publication of statements of unsolved problems and expository papers.
5. To exhibit the mathematical richness of design theory in relation to almost all branches of pure mathematics and thus interest workers in these areas as well.
6. To decrease subscription costs for design theorists by having to subscribe to fewer journals.

Reasons advanced opposing the establishment of a separate journal were:

1. Statisticians and mathematicians with marginal interest in statistical design may not bother to read articles in a specialized journal, whereas they would at least be aware of them if design articles were published in a journal read by them.

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2. Splitting of fields of statistics is not considered beneficial to the entire field of statistics.

3. If most articles on design were published in a new journal on statistical design, it could mean the demise or considerable reduction in size of several journals.

4. The publication of three new statistical journals (Communications in Statistics, Utilitas Mathematica, and The Canadian Journal of Statistics) relieves the present pressure associated with publishing statistical design articles.

5. The split of the Annals of Mathematical Statistics into two journals should be given time to ascertain its impact before a new journal on design is started.

6. It is not known if sufficient material is published on statistical design to start a new journal.

In order to determine if the volume of published material on statistical design was sufficient to launch a new journal, a current survey of published material was required. The purpose of the present study was to determine the number of articles published and the number of printed pages devoted to statistical design for the four-year period 1968 through 1971 in 18 statistical journals, selected because of their availability. The journals surveyed were:

1. The American Statistician
2. The Annals of Mathematical Statistics
3. The Annals of the Institute of Statistical Mathematics
4. Applied Statistics (Journal of the Royal Statistical Society, Series C)
5. The Australian Journal of Statistics
6. Biometrics
7. Biometrika
8. Calcutta Statistical Association Bulletin (except for 1971)
9. Journal of the American Statistical Association
10. Journal of Combinatorial Theory (A and B)
11. Journal of the Indian Society of Agricultural Statistics

12. Journal of the Royal Statistical Society, Series B
13. Proceedings of the nth Conference on the Design of Experiments in Army Research Development and Testing
14. Reports of Statistical Application Research
15. Revue de l'Institut International de Statistique
16. Sankhyā, The Indian Journal of Statistics, Series A
17. Sankhyā, The Indian Journal of Statistics, Series B
18. Technometrics

The articles considered were those related to statistical design and analysis for the following seven categories (see Federer and Balaam, 1973):

Experiment Design (ED) - The arrangement of treatments in an experimental investigation.

Treatment Design (TD) - The selection of treatments to be included in an experiment.

Measuring and Measurements (M) - The concepts and techniques associated with obtaining measurements on a given phenomenon in an investigation.

Sample Survey Design (SS) - The arrangement or allocation of the sampling units in a survey investigation.

Sequential Design (SD) - The selection of successive observations in a sequential investigation.

Modeling Design (MD) - The selection of points to obtain measurements in the formulation of models or of model building in an investigation.

Other (O) - Statistical articles relating to one or more of the above six categories but not specifically related to any particular one.

The numbers of articles on design for each of the four years and for each of the 18 journals are presented in Table 1. The Annals of Mathematical Statistics published 110 of the 659 articles included, with the next three largest publishers being Biometrics (64), Biometrika (62), and Technometrics (59). These four journals published about 45% of the articles on design. With regard to number of printed pages (Table 2), these four journals published about 42% of the total.

The Proceedings of the nth Conference on the Design of Experiments in Army Research Development and Testing ranked fourth in number of printed pages; this material is photo-offset from typed manuscripts resulting in more pages than if the material were typeset as is the case for the other journals.

The number of articles on design for each of seven categories of classification by journal is presented in Table 3. It should be noted that the number of papers on experiment design (ED) and on treatment design (TD) are each roughly twice that of the third category, survey design (SS). There are relatively few articles on sequential design (SD), model-building design (MD), and on measuring and measurements (M); it is expected that articles in these areas will increase in the future and that model-building design and analyses will be one of the fast growing fields in the next quarter century whether in or out of the field of statistics. Statisticians should maintain an active interest in model building theory and techniques. As may be noted, there would be insufficient articles published in these 18 journals in the area of model building to warrant publication of a new journal. However, several additional journals should be surveyed to determine the volume of literature as statistical journals may not be the primary source of publication.

Roughly the same relation holds for printed pages by category of classification and journal (Table 4) as for number of pages. The majority of the pages published are on experiment, treatment, and sample survey design. Limiting a statistical design journal to these three categories would result in a total of 5689 pages published for the four-year period, or about 1400 pages per year.

In order to ascertain the relative proportion of a journal being devoted to design articles, the total number of articles (excluding book reviews, queries, notices, etc.) and the total number of pages printed in each volume per year of a journal are given in Table 5. Supplementary pages were not included. These results

are useful in determining the effect of deleting design articles on the size of the journal. The Annals of Mathematical Statistics and the Journal of the American Statistical Association together publish about one-third of the material in these 18 journals.

Some specific items to note in Table 5 are occasional large changes in pages published per year. In particular, for the Journal of the American Statistical Association, there is a decrease from 1709 pages in 1970 to 934 pages in 1971, with an increase from 132 to 148 articles for the same period. This journal published more articles and probably more printed material because the page size was increased considerably in 1971. For the Journal of Combinatorial Theory, the A series and the B series were started in 1971, resulting in the larger number of articles and pages. For the Journal of the Indian Society of Agricultural Statistics in 1971, a Silver Jubilee issue (Number 2) was published resulting in more articles and pages.

With the results in Table 5, percentages of articles and pages on statistical design were computed and are given in the last column of Tables 1 and 2. It is interesting to note that The American Statistician and the Journal of the American Statistical Association contain the lowest percentages of design articles, whereas the Calcutta Statistical Association Bulletin and the Journal of the Indian Society of Agricultural Statistics contain the highest proportion. The Journal of the American Statistical Association has a relatively low percentage (2.7%) of articles on experiment and treatment design, a total of 14 for the four-year period. For these 18 journals, roughly one out of seven articles is on statistical design. Hence, design articles constitute a sizeable proportion (15.6%) of statistical papers published. It would appear that some journals could increase in size if there is a need. The only difficulty is that persons interested in statistical design need to have access to a large number of journals. However,

the total cost of these 18 journals is of the order of $200 per year and is a tax-deductible item, so this is not considered a serious difficulty.

It should be noted that about one-seventh of the printed literature on design in the 18 journals appears in the Annals of Mathematical Statistics. Thus, this journal is important to anyone interested in the theoretical aspects of design. In order to illustrate the nature of the more mathematical and theoretical articles included from the above 18 journals, the page numbers and classification of each of the selected articles from volume 39 of the Annals of Mathematical Statistics are given below:

Volume 39, 1968, pages: 49-69(TD), 88-92(SD), 159-163(TD), 200-208(TD), 242-245 (TD), 246-255(TD), 278-281(SS), 286-288(MD), 457-465(TD), 583-592(TD), 606-620 (SS), 643-656(ED), 657-663(TD), 681-683(ED), 967-972(ED), 973-982(TD,SD), 999-1006(ED), 1040-1047(SD), 1176-1185(SD), 1220-1227(MD), 1435-1447(TD), 1486-1492 (ED), 1517-1539(TD), 1540-1548(ED), 1577-1590(ED), 1675-1685(SD), 1744-1746(ED), 1825-1843(TD), 1953-1977(SD), 1978-1994(TD), 1995-2001(TD), 2002-2015(TD), 2075-2093(O), 2103-2107(SD).

The volume of articles published was surprisingly large in that 659 articles were published in the four-year period. The corresponding number of pages published was 7009. This means that approximately 165 articles with a total of 1752 pages are published each year on statistical design and analysis. Considering that 500-1000 pages per year is a substantial journal, there appears to be sufficient material to warrant founding a statistical design journal on this basis alone. However, before such a venture is started, other criteria need consideration.

Table 1. Number of articles on design by year.

Journal	Year 1968	1969	1970	1971	Sum	% of Total
1. Amer.Statistician	1	2	6	6	15	7.7
2. Annals Math.Stat.	34	21	26	29	110	12.2
3. Annals Inst.Stat.Math.	6	6	5	12	29	14.5
4. Applied Statistics	4	5	8	8	25	15.3
5. Australian Jour.Stat.	2	4	6	4	16	23.2
6. Biometrics	18	12	12	22	64	20.6
7. Biometrika	15	16	15	16	62	18.7
8. Calcutta Stat.Assoc.	8	5	9	--	22	50.0
9. Jour.Amer.Stat.Assoc.	13	13	7	10	43	8.3
10. Jour.Combinatorial Theory	5	14	9	13	41	10.4
11. Jour.Indian Soc.Agri.Stat.	4	4	6	14	28	37.8
12. Jour.Royal Stat.Soc., B	14	8	3	8	33	19.5
13. Proc.Conf.Des.Expt.Army	8	2	13	7	30	24.4
14. Reports Stat.Appl.Res.	4	5	4	1	14	23.3
15. Rev.Int.Stat.Inst.	5	1	1	6	13	14.1
16. Sankhyā, Series A	3	9	8	9	29	16.4
17. Sankhyā, Series B	8	10	2	6	26	25.7
18. Technometrics	22	13	11	13	59	19.4
Total	174	150	151	184	659	15.6

Table 2. Number of printed pages of design articles by year.

Journal	Year 1968	1969	1970	1971	Sum	% of Total
1. Amer.Statistician	2	4	25	23	54	5.4
2. Annals Math.Stat.	355	209	224	245	1033	11.7
3. Annals Inst.Stat.Math.	51	46	43	145	285	13.2
4. Applied Statistics	42	44	78	79	243	19.6
5. Australian Jour.Stat.	15	31	30	26	102	14.9
6. Biometrics	233	111	98	227	669	17.2
7. Biometrika	137	155	149	123	564	21.0
8. Calcutta Stat.Assoc.	98	106	89	--	293	54.8
9. Jour.Amer.Stat.Assoc.	180	198	82	49	509	8.6
10. Jour.Combinatorial Theory	29	129	103	118	379	10.2
11. Jour.Indian Soc.Agri.Stat.	36	44	60	142	282	27.0
12. Jour.Royal Stat.Soc.,B	207	97	60	97	461	22.6
13. Proc.Conf.Des.Expt.Army	157	66	266	141	630	25.7
14. Reports Stat.Appl.Res.	31	52	50	8	141	21.3
15. Rev.Int.Stat.Inst.	35	26	16	66	143	9.1
16. Sankhyā, Series A	26	76	54	128	284	14.6
17. Sankhyā, Series B	80	89	27	56	252	12.4
18. Technometrics	269	144	120	152	685	18.9
Total	1983	1627	1574	1825	7009	15.2

Table 3. Number of articles on design by type.

Journal	Type of design article							
	ED	TD	SS	SD	MD	M	O	Total
1. Amer.Statistician	5	4	5	0	0	0	1	15
2. Annals Math.Stat.	32	44	8	17	4	0	5	110
3. Annals Inst.Stat.Math.	6	13	8	1	1	0	0	29
4. Applied Statistics	0	10	7	1	4	1	2	25
5. Australian Jour.Stat.	2	5	6	1	2	0	0	16
6. Biometrics	21	17	9	3	8	2	4	64
7. Biometrika	23	21	8	7	2	0	1	62
8. Calcutta Stat.Assoc.	9	7	4	0	2	0	0	22
9. Jour.Amer.Stat.Assoc.	6	8	22	4	1	2	0	43
10. Jour.Combinatorial Theory	36	4	0	0	0	0	1	41
11. Jour.Indian Soc.Agri.Stat.	8	9	11	0	0	0	0	28
12. Jour.Royal Stat.Soc.,B	3	13	10	3	2	0	2	33
13. Proc.Conf.Des.Expt.Army	12	11	3	0	3	1	0	30
14. Reports Stat.Appl.Res.	9	4	1	0	0	0	0	14
15. Rev.Int.Stat.Inst.	3	1	6	0	2	0	1	13
16. Sankhyā, Series A	14	0	9	3	2	0	1	29
17. Sankhyā, Series B	3	5	14	0	4	0	0	26
18. Technometrics	7	35	4	1	9	2	1	59
Total	199	211	135	41	46	8	19	659

Table 4. Number of printed pages of design articles by type.

Journal	Type of design ED	TD	SS	SD	MD	M	O	Total
1. Amer.Statistician	18	14	20	0	0	0	2	54
2. Annals Math.Stat.	229	467	49	187	29	0	72	1033
3. Annals Inst.Stat.Math.	48	100	109	10	18	0	0	285
4. Applied Statistics	0	101	60	7	52	9	14	243
5. Australian Jour.Stat.	10	27	47	8	10	0	0	102
6. Biometrics	225	175	88	56	74	22	29	669
7. Biometrika	233	193	35	72	23	0	8	564
8. Calcutta Stat.Assoc.	122	69	61	0	41	0	0	293
9. Jour.Amer.Stat.Assoc.	77	98	257	46	7	24	0	509
10. Jour.Combinatorial Theory	332	41	0	0	0	0	6	379
11. Jour.Indian Soc.Agri.Stat.	89	73	120	0	0	0	0	282
12. Jour.Royal Stat.Soc.,B	33	158	150	61	41	0	18	461
13. Proc.Conf.Des.Expt.Army	328	140	73	0	80	9	0	630
14. Reports Stat.Appl.Res.	79	54	8	0	0	0	0	141
15. Rev.Int.Stat.Inst.	19	11	90	0	16	0	7	143
16. Sankhyā, Series A	132	0	64	30	28	0	30	284
17. Sankhyā, Series B	12	54	144	0	42	0	0	252
18. Technometrics	72	429	52	3	104	13	12	685
Total	2058	2204	1427	480	565	77	198	7009

Table 5. Total number of articles published and total number of pages printed by year and journal.

Journal	Number of Articles					Number of printed pages				
	1968	1969	1970	1971	Total	1968	1969	1970	1971	Total
1. Amer.Statistician	50	57	36	51	194	220	244	248	296	1008
2. Annals Math.Stat.	219	224	232	228	903	2188	2237	2196	2213	8834
3. Annals Inst.Stat.Math.	43	54	59	44	200	523	556	556	529	2164
4. Applied Statistics	42	44	33	44	163	301	300	292	346	1239
5. Australian Jour.Stat.	13	16	22	18	69	143	178	176	187	684
6. Biometrics	76	65	82	87	310	1055	818	885	1121	3879
7. Biometrika	83	81	87	80	331	599	718	684	688	2689
8. Calcutta Stat.Assoc.	13	13	18	--	44	174	188	173	--	535
9. Jour.Amer.Stat.Assoc.	108	130	132	148	518	1574	1728	1709	934	5945
10. Jour.Combinatorial Theory	83	110	81	122	396	829	801	879	1203	3712
11. Jour.Indian Soc.Agri.Stat.	13	16	16	29	74	207	281	232	324	1044
12. Jour.Royal Stat.Soc.,B	51	49	36	33	169	601	552	434	457	2044
13. Proc.Conf.Des.Expt.Army	28	26	36	33	123	474	507	859	611	2451
14. Reports Stat.Appl.Res.	15	15	17	13	60	142	186	186	147	661
15. Rev.Int.Stat.Inst.	21	15	27	29	92	375	348	436	410	1569
16. Sankhyā, Series A	40	49	46	42	177	454	516	478	494	1942
17. Sankhyā, Series B	32	33	18	18	101	478	560	574	426	2038
18. Technometrics	70	62	80	92	304	891	851	944	937	3623
Total	1000	1059	1058	1111	4228	11228	11569	11941	11323	46061

Acknowledgements

Although a number of informal discussions were held from time to time, serious consideration for starting a new journal on statistical design was held in March, 1972, with A. Hedayat, J. Kiefer, B. L. Raktoe, and J. N. Srivastava participating. Several discussions by members of this group were held with R. C. Bose, I. Olkin, and E. Seiden. In addition, the opinions of J. N. Pratt (previous Editor of JASA) were obtained via telephone. The decision on which articles were to be included in statistical design was made by W. T. Federer, A. Hedayat, and B. L. Raktoe for several of the 18 journals. First pages of all selected articles were photo-copied and a classification was made.

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Reference

Federer, W. T. and Balaam, L. N. [1973]. Bibliography on Experiment and Treatment Design: Pre-1968. Published for the International Statistical Institute by Oliver & Boyd, Edinburgh. (Distributed in the United States by Hafner Publishing Co., New York.)